Lecture 12:
Business Cycles

Macroeconomics (Quantitative)
Economics 101B

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Long Run Versus Short Run

- Classical economics:
  - Emphasizes self-equilibrating forces (supply=demand, long-run monetary neutrality)
  - In the long run, these forces bring about good outcomes
- But economies are buffeted by shocks that result in serious pathologies such as high inflation and high unemployment
  - Great Depression, Early 1980s recession, 2007-2009 financial crisis

Long Run Versus Short Run

But this “long run” is a misleading guide to current affairs.
“In the long run” we are all dead.

Economists set themselves too easy, too useless a task if in tempestuous seasons they can only tell us that when the storm is long past the ocean is flat again.

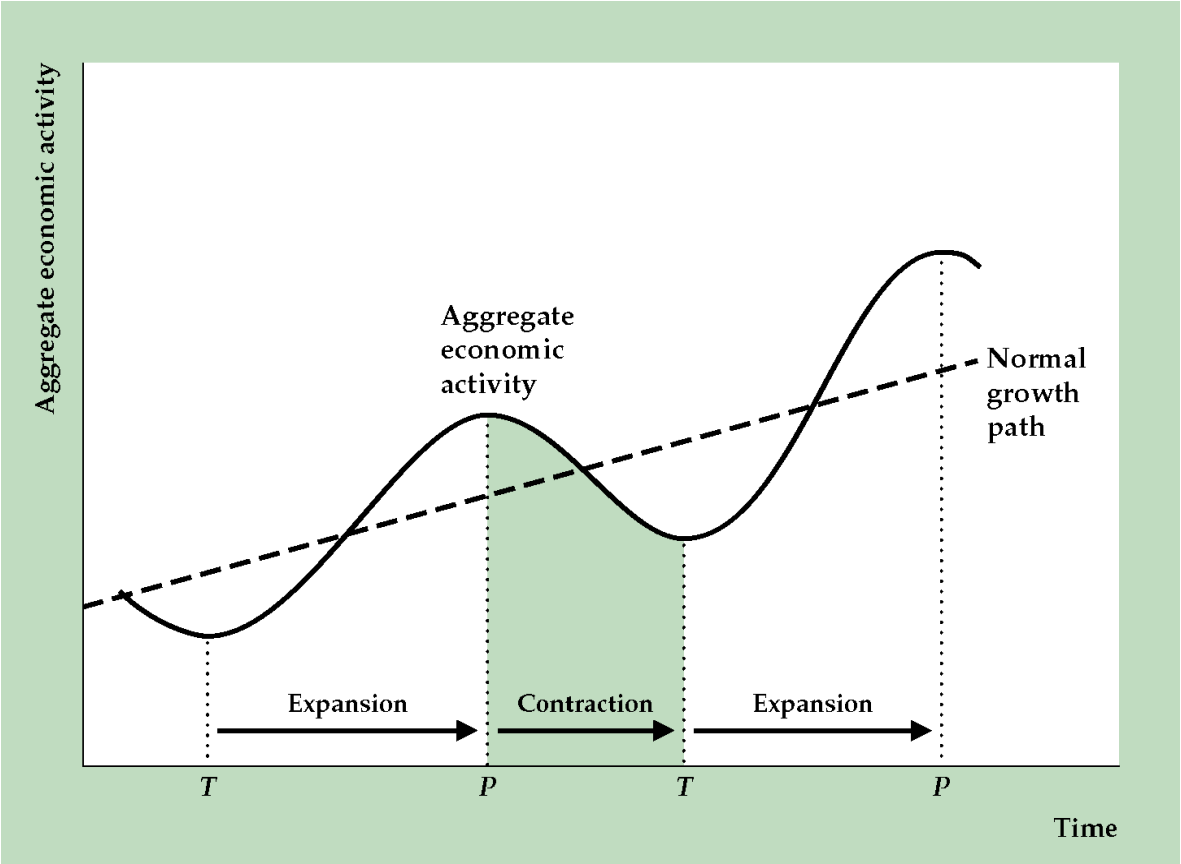
- John Maynard Keynes

Long Run Versus Short Run

- (Keynesian) Macroeconomics:
  - Born as separate sub-discipline in the Great Depression
  - Obvious that long-run forces not working well
  - Increased focus on workings of the economy in the short run
  - Increased focus on “business cycles” and crises

Business Cycles

- Output fluctuates around a trend
- Fluctuations called business cycles
- Recurrent but not periodic
  - Last approximately from 2 to 10 years
- Phases:
  - Expansion phase (trough to peak)
  - Contraction phase (peak to trough)
- "Official" arbiter:
  - Business Cycle Dating Committee of the National Bureau of Economic Research



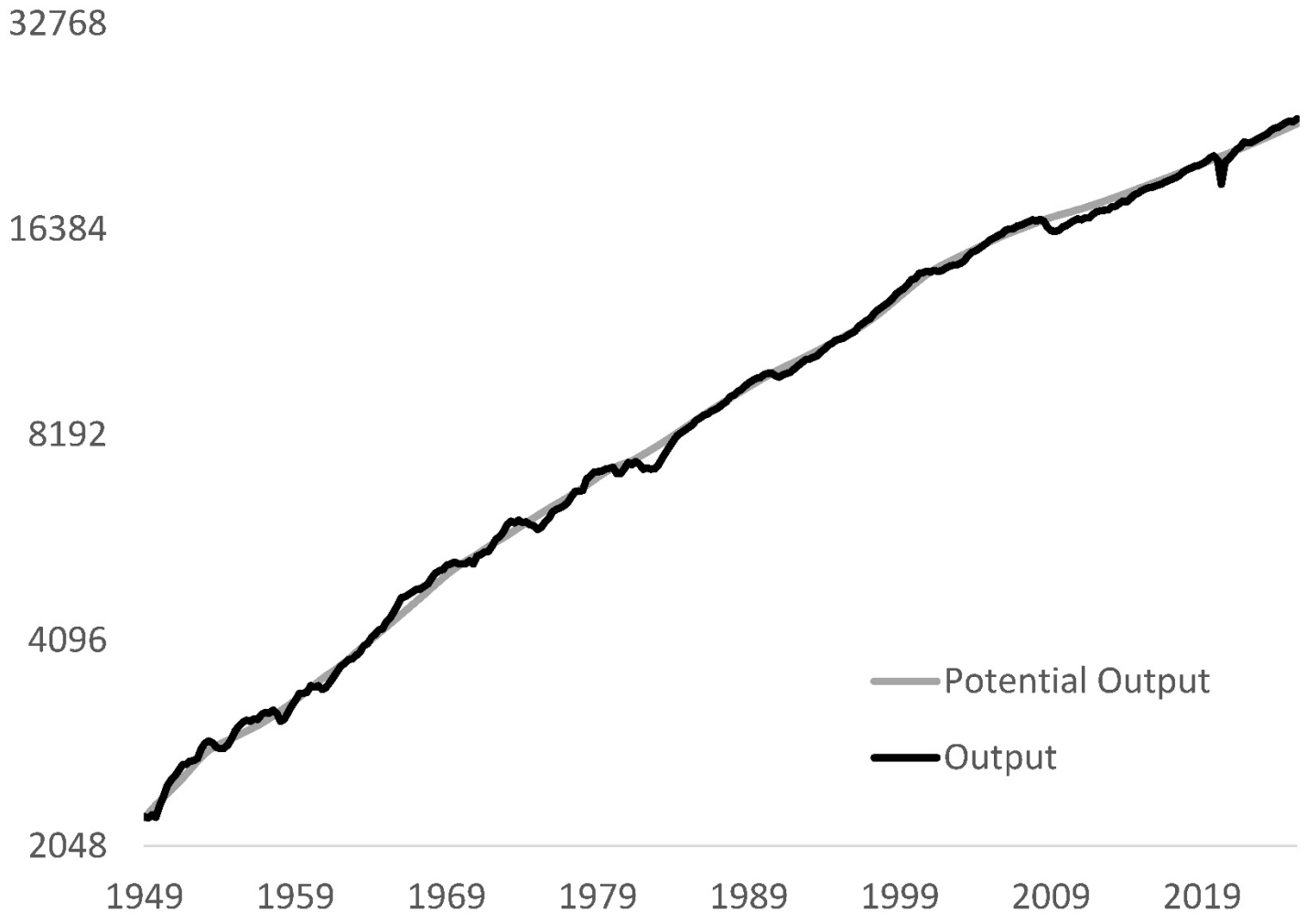
Trend and Cycle

- Useful to decompose output into trend and cycle
- We think of trend output as “potential output” or the “natural rate of output”. Let’s denote this as $\bar{Y}_t$.
- We define the output gap as percentage deviations of output from potential output

$$\tilde{Y}_t = \frac{Y_t - \bar{Y}_t}{\bar{Y}_t} \approx \log\left(\frac{Y_t}{\bar{Y}_t}\right)$$

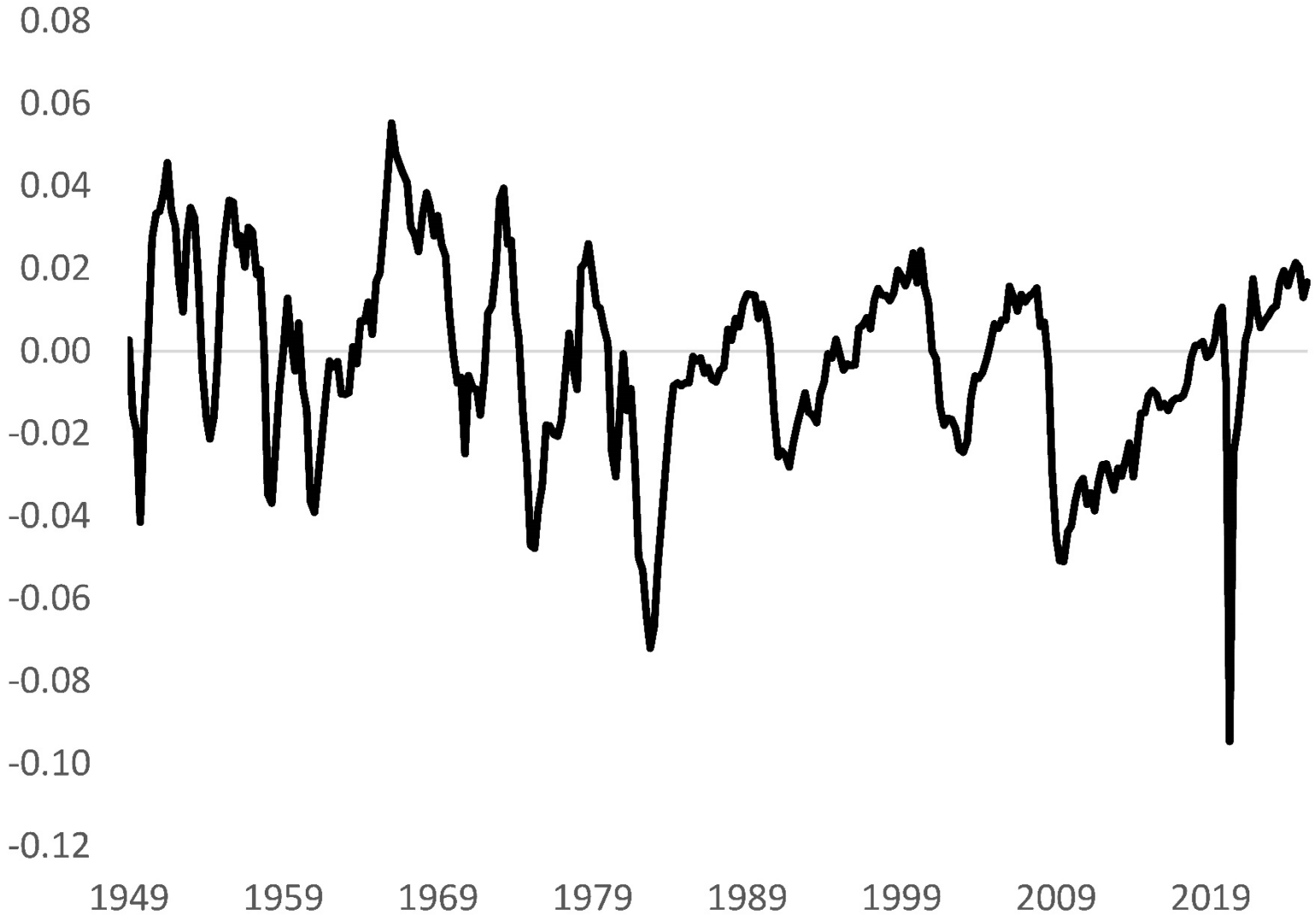
The Trend: Potential Output

- Here I plot output (real GDP) and potential output as estimated by the Congressional Budget Office
- Difference looks small relative to growth in output
- These differences are recessions and booms



The Business Cycle

- Here I plot the output gap measured as the difference between log output and log potential output (from CBO)
- Recessions cause up to 10% fall in output relative to potential



Our First "Business Cycle" Model

- Medieval Economy:
  - Money market equilibrium:

$$M_t \bar{V} = P_t Y_t$$

  - Price Adjustment:

$$\frac{P_{t+1}}{P_t} = \left(\frac{Y_t}{Y^*}\right)^{\theta}$$

- Many things missing:
  - No trend growth
  - No steady state inflation
  - No unemployment
  - No interest rate
  - No monetary policy
  - No fiscal policy
  - Etc.

Add Trend Growth

- Let's add trend growth to medieval economy
- Steady state becomes "trend growth path"
- We assume that TFP has a positive trend growth rate.
  So we have A_t rather than A. (A_t is still exogenous.)
- Actual output: $Y_t = A_t L_t$
- Potential output (natural rate of output): $\bar{Y}_t = A_t L^*$
- Employment is at desired level L^* when output is at potential

Medieval Economy with Trend Growth

- Medieval economy without trend growth

$$M_t\bar{V} = P_tY_t \qquad \frac{P_{t+1}}{P_t} = \left(\frac{Y_t}{Y^*}\right)^{\theta}$$

- Medieval economy with trend growth

$$M_t\bar{V} = P_tY_t \qquad \frac{P_{t+1}}{P_t} = \left(\frac{Y_t}{Y_t^*}\right)^{\theta}$$

- Only difference is that Y^* becomes Y_t^*

Business Cycle Model

- Can we use concepts of supply and demand to think about the Medieval economy model?
- Let's start with the money market equilibrium condition:

$$M_t \bar{V} = P_t Y_t$$

- Take logs and time differences:

$$\Delta \log M_t = \Delta \log P_t + \Delta \log Y_t$$

Money Market Equilibrium

$$\Delta \log M_t = \Delta \log P_t + \Delta \log Y_t$$

- Inflation:

$$\Delta \log P_t = \log\left(\frac{P_t}{P_{t-1}}\right) = \log(1 + \pi_t) \approx \pi_t$$

- Output gap:

$$\begin{aligned} \Delta \log Y_t &= \log Y_t - \log Y_{t-1} + \log \bar{Y}_t - \log \bar{Y}_t + \log \bar{Y}_{t-1} - \log \bar{Y}_{t-1} \\ &= \log(Y_t/\bar{Y}_t) - \log(Y_{t-1}/\bar{Y}_{t-1}) + \log(\bar{Y}_t/\bar{Y}_{t-1}) \\ &\approx \tilde{Y}_t - \tilde{Y}_{t-1} \end{aligned}$$

We drop this term. Think of it as a constant that doesn't contribute anything interesting to the analysis

- This yields:

$$\Delta \log M_t = \pi_t + \tilde{Y}_t - \tilde{Y}_{t-1}$$

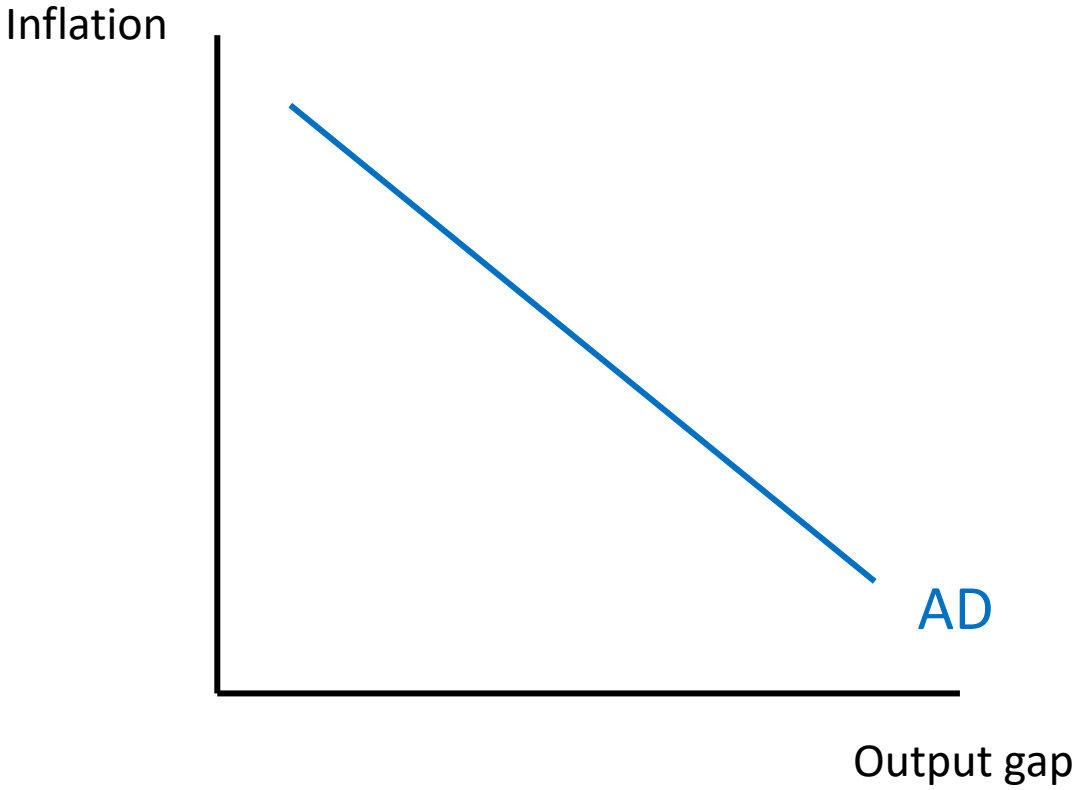
Money Market Equilibrium as Aggregate Demand

$$\Delta \log M_t = \pi_t + \tilde{Y}_t - \tilde{Y}_{t-1}$$

- We can rewrite this as

$$\pi_t = -\tilde{Y}_t + \tilde{Y}_{t-1} + \Delta \log M_t$$

- Plot this relationship in $(\pi_t, \tilde{Y}_t)$ space
- Downward sloping locus of points
- We call this the aggregate demand curve



Price Setting Equation

$$\frac{P_{t+1}}{P_t} = \left(\frac{Y_t}{Y_t^*}\right)^{\theta} \quad \rightarrow \quad \frac{P_t}{P_{t-1}} = \left(\frac{Y_{t-1}}{Y_{t-1}^*}\right)^{\theta}$$

- Replace: Y_t^* with $\bar{Y}_t$ (i.e., assume desired output is same as potential output)
- Take logs:

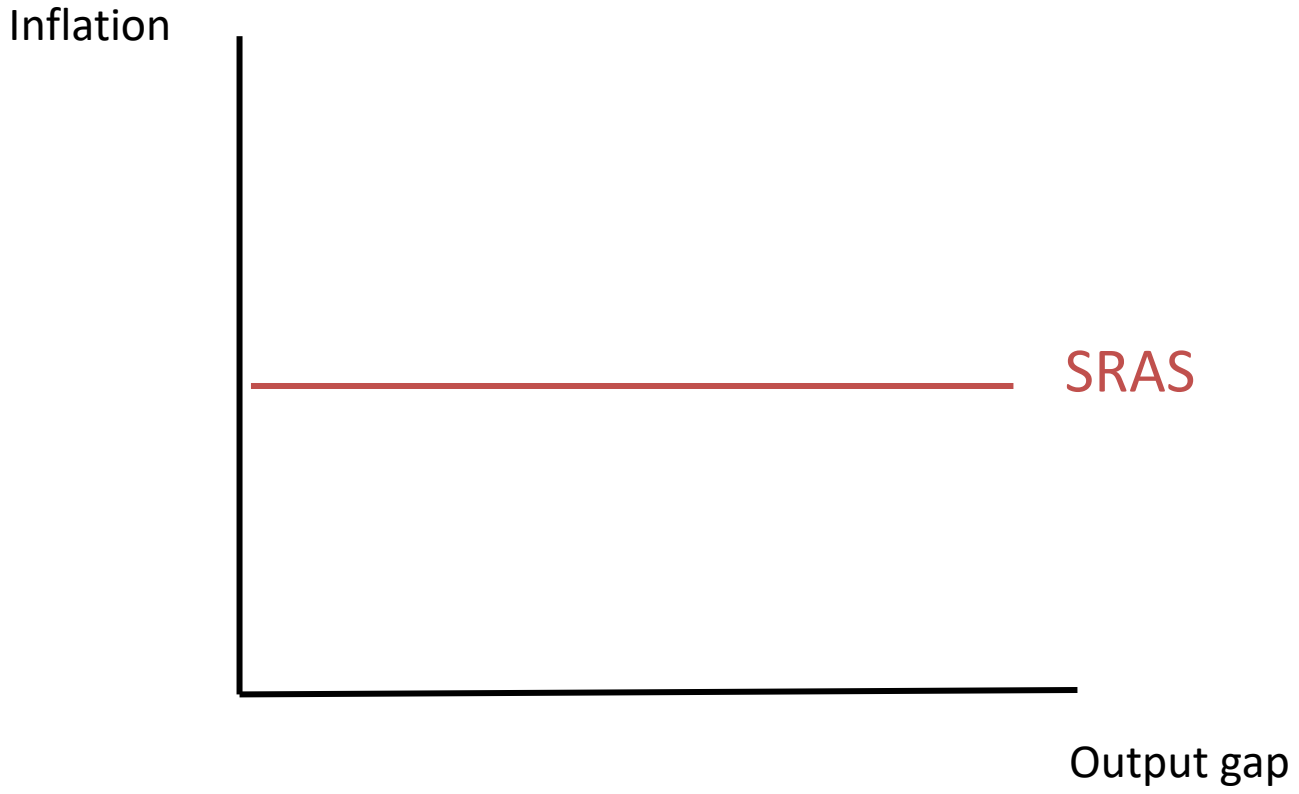
$$\log\left(\frac{P_t}{P_{t-1}}\right) = \theta \log\left(\frac{Y_{t-1}}{\bar{Y}_{t-1}}\right)$$

$$\pi_t = \theta \tilde{Y}_{t-1}$$

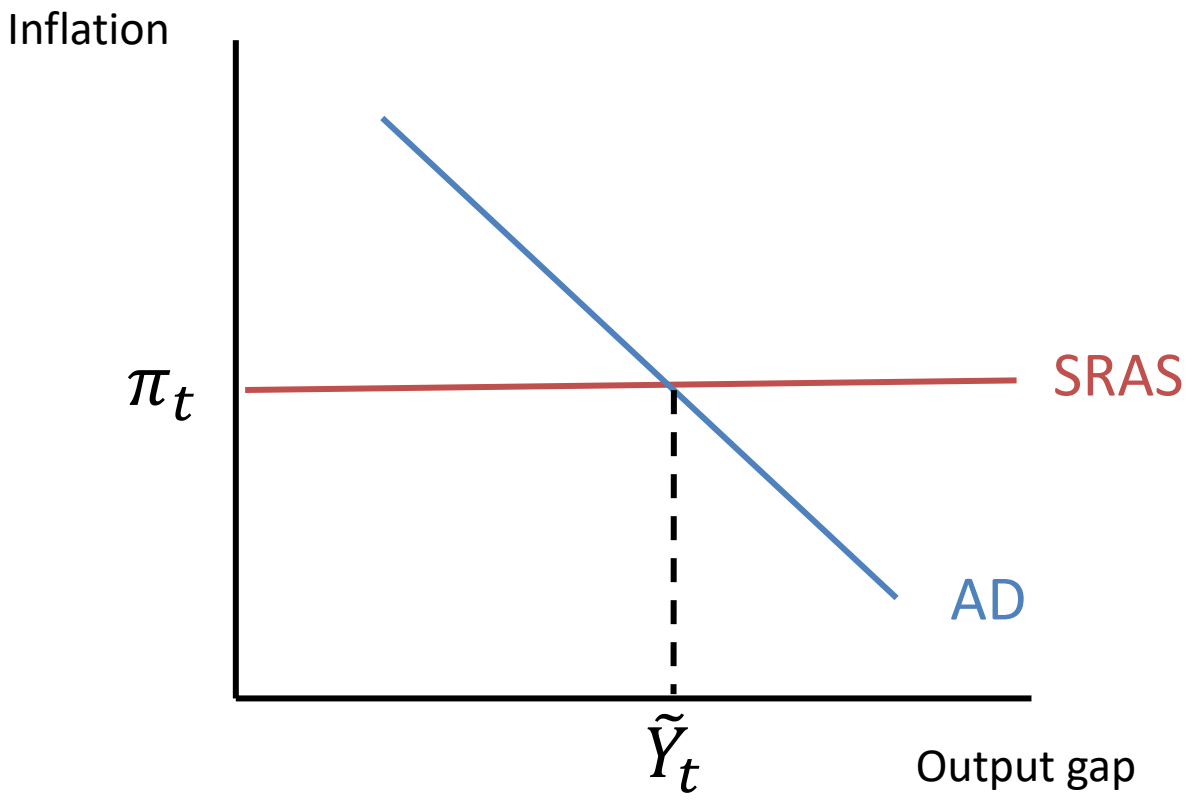
Short Run Aggregate Supply

$$\pi_t = \theta \tilde{Y}_{t-1}$$

- Very simple short-run aggregate supply relation
- What is its slope?
- Short run:
  - Inflation is fixed
  - Predetermined one period in advance
  - Horizontal short-run aggregate supply curve (SRAS)



Short Run Equilibrium



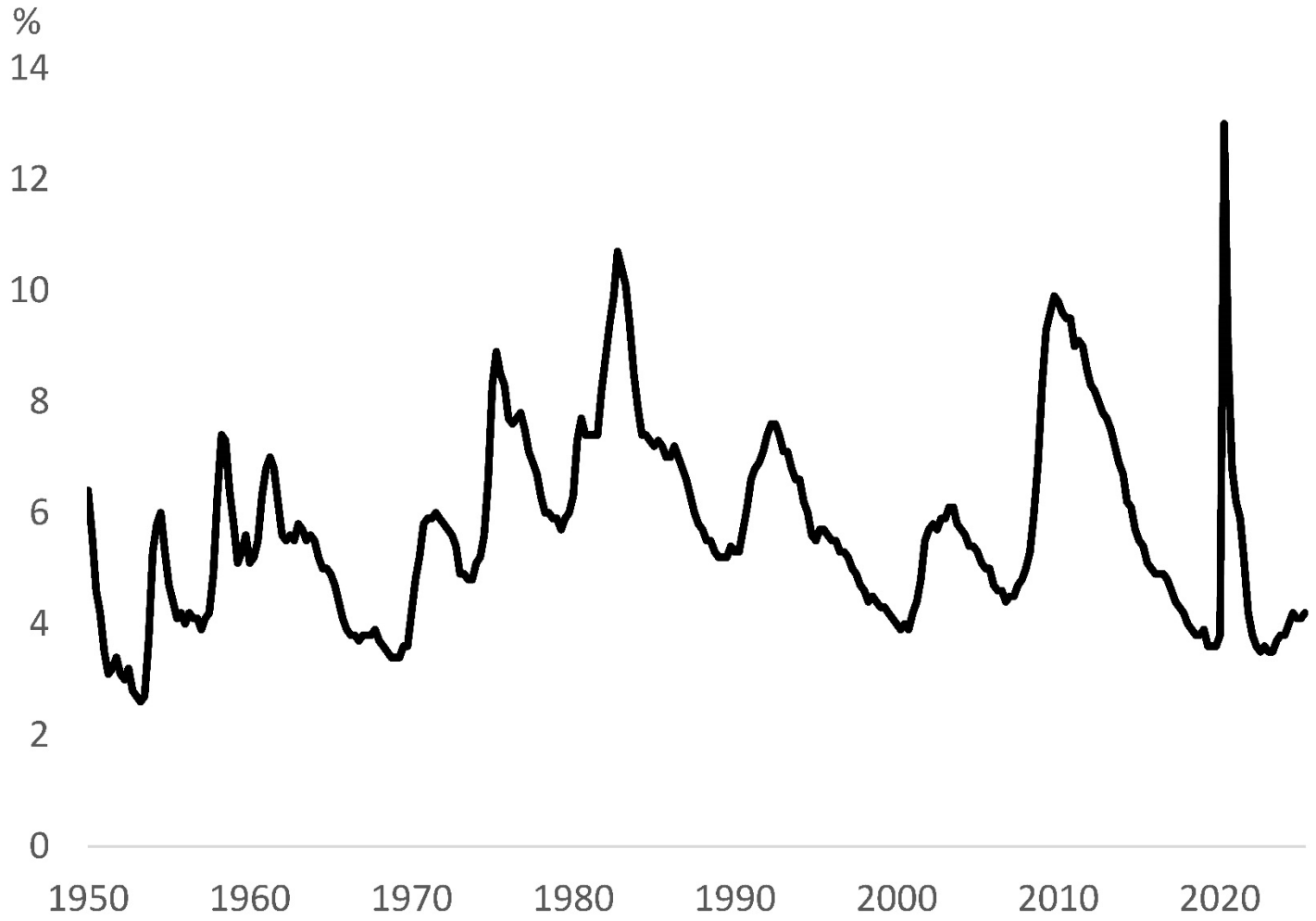
Output Gap and Unemployment

- Measuring output gap is tricky!
- Trend productivity growth varies over time
  - Productivity slowdown in 1970s
  - Productivity speedup between 1995-2004
- Hard to know exactly how to draw a trend line for output
- Alternative: Look at unemployment

Unemployment Rate

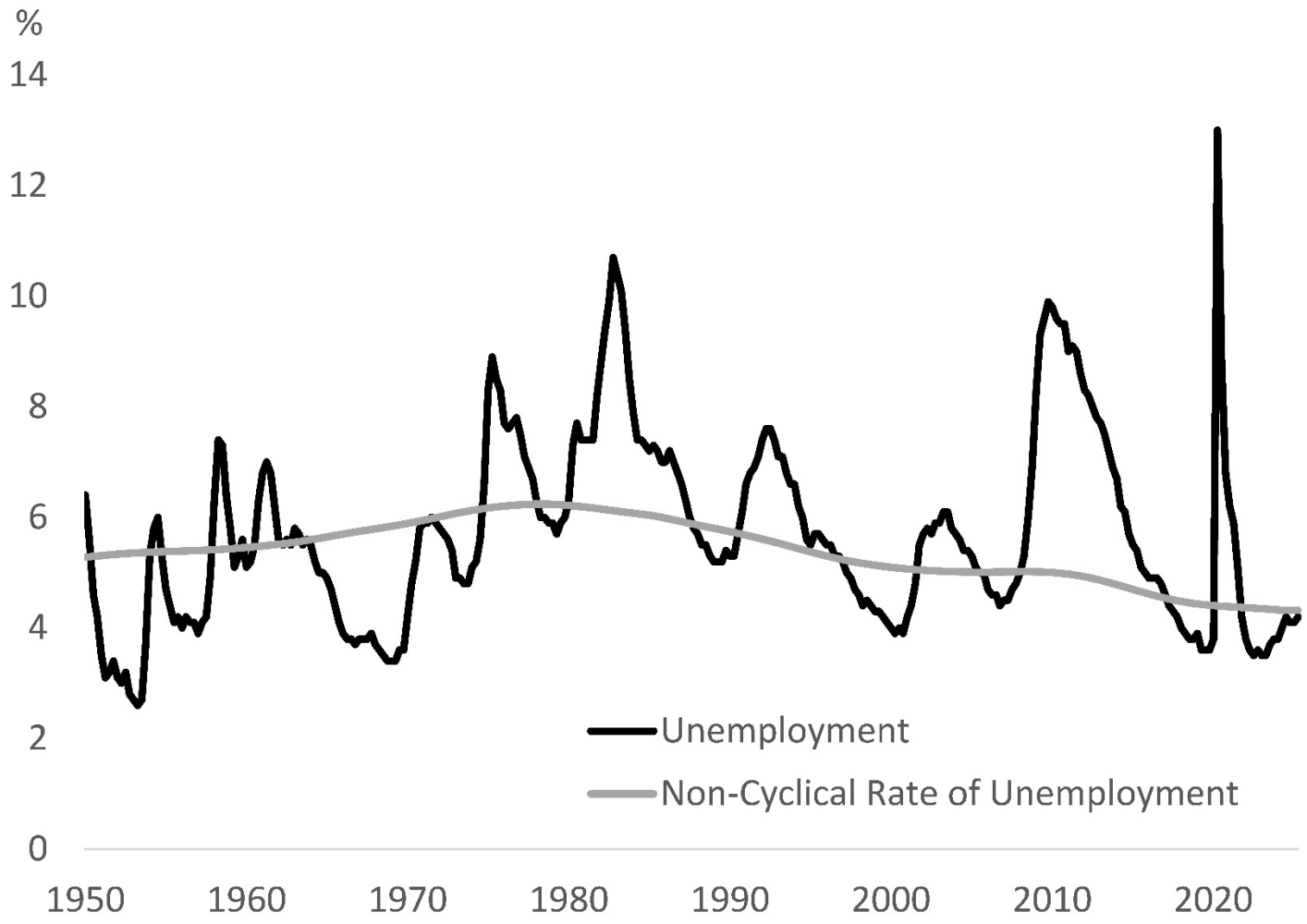
- Unemployment rate rises during recessions and falls during expansions
- No trend

- But what is the “natural rate” of unemployment?
- Should we aim for zero unemployment?



Natural Rate of Unemployment

- People quit and are fired
- Takes time for them to search for new jobs
- Natural rate of unemployment reflects this "frictional" unemployment
- Here I plot CBO estimate of "non-cyclical" unemployment
- Is natural rate really that high?

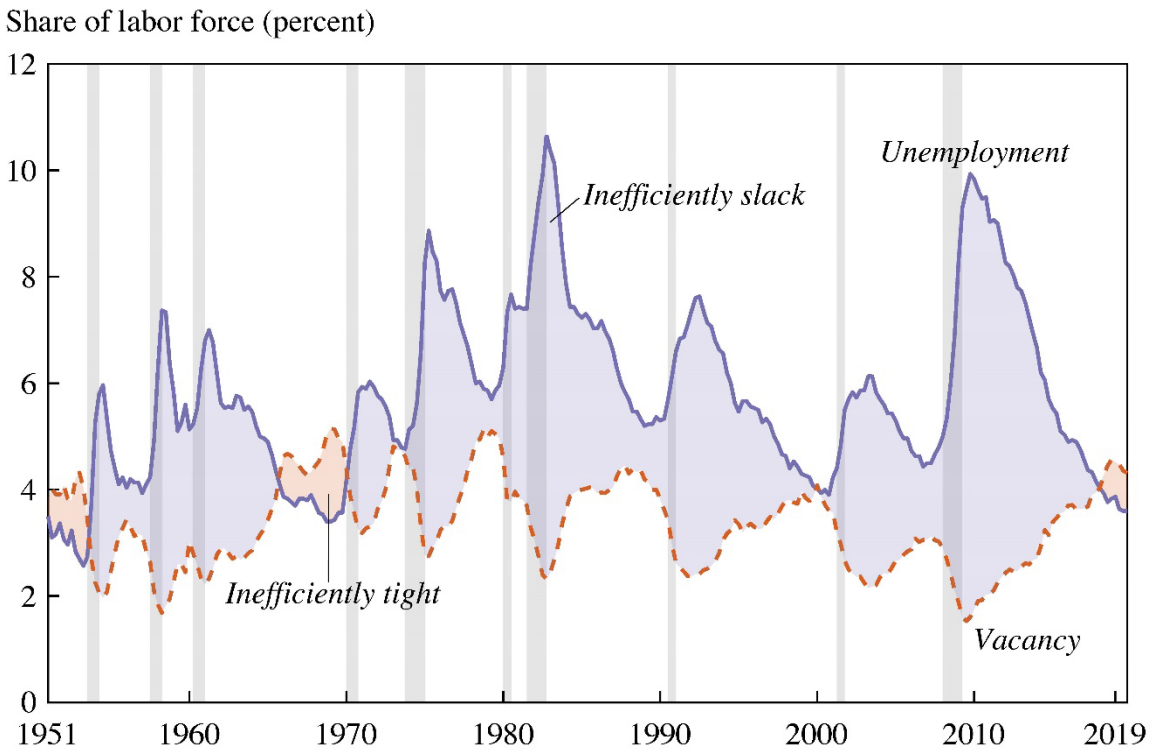


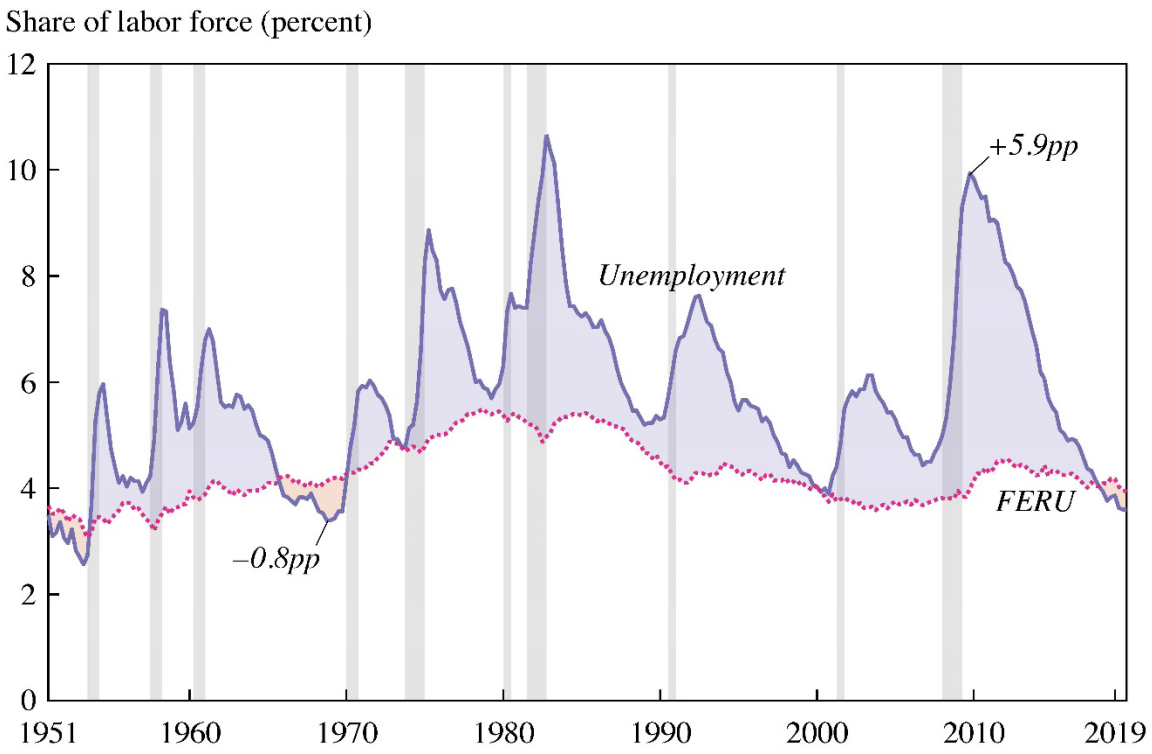
Full Employment Rate of Unemployment

- Michaillat and Saez: Want to minimize nonproductive use of labor
- Two types of "nonproductive" use of labor
  - 1) Unemployment (u) 2) Recruitment (v)
- These are necessary, but don't produce output
- When $u > v$ labor market is too slack
- When $u < v$ labor market is too tight
- Productive labor is maximized when $u = v$ which implies

$$u^* = \sqrt{uv}$$

Full Employment Rate of Unemployment





Source: Unemployment rate u and vacancy rate v come from figure 1.
Note: The FERU is $u^* = \sqrt{uv}$. The vertical gray areas are NBER-dated recessions.

Okun's Law

- Useful to be able to go back and forth between output and unemployment
- During recessions output is low and the unemployment rate is high
- "Stable" empirical relationship:

$$u_t - u^n = -\frac{1}{2}\tilde{Y}_t$$

- This is called "Okun's Law"